IX. *Obſervations and Remarks on thoſe Stars which the Aſtronomers of the laſt Century ſuſpected to be changeable. By* Edward Pigott, *Eſq.; communicated by Sir* Henry C. Englefield, Bart. *F. R. S. and A. S.*

Read February 9, 1786.

IT is about a century ſince HEVELIUS, MONTANARI, FLAMSTEED, MARALDI, and CASSINI, noticed a certain number of ſtars which they ſuppoſed had either diſappeared, changed in brightneſs, or were new ones; and yet to this day we have acquired no further knowledge of them. This may be attributed to the difficulty of finding out what ſtar is meant, and the not having exact obſervations of their relative brightneſs. I therefore have drawn up the following catalogue, and made the neceſſary obſervations; ſo that in future we can examine them without much trouble, and be certain of any change that may take place. To accompliſh this, it was requiſite to compare with attention many authors and moſt of the catalogues of ſtars; in doing which I have perceived ſeveral undoubted errors, and others highly probable; but as entering into a diſcuſſion of ſuch diſagreements would ſwell this account conſiderably, and make it very intricate, I ſhall avoid, as much as poſſible, any thing of the kind that is not immediately neceſſary.

In order to ſeparate certainty from doubt, I have claſſed theſe ſtars in two diviſions; the firſt are undoubtedly changeable;

the others remain yet to be better authenticated. Though ſome of them bear all the appearance of being variable, ſtill no *certainty* of their being ſo has come to my knowledge. To thoſe of the firſt claſs are ſubjoined obſervations made on them within theſe laſt four years, from which the period and progreſſive changes of ſome are deduced, though never ſettled before, and if already known are more exactly determined by comparing my obſervations with former ones. Alſo, as the poſition of ſeveral are determined only by ancient aſtronomers, and therefore inaccurately, I have obſerved them with great exactneſs, the declinations being taken with a BIRD's eighteen-inch quadrant, and the right aſcenſions with a three-feet tranſit inſtrument: theſe laſt may ſerve in future to diſcover their proper motions in right aſcenſion, for which reaſon I ſhall ſpecify the ſtars to which they were compared. The ſtars of the ſecond claſs have either their relative brightneſs exactly ſettled, or their non-exiſtence aſcertained. I have alſo pointed out the probability of a miſtake in ſeveral, and in general given an account of the appearance they have had within theſe few years.

Catalogue of variable Stars, reduced to the beginning of 1786.

Claſs the firſt.

Names.	R. A. in time.			Declination.			Greateſt and leaſt magnitudes.	From whence reduced.
	h.	′	″	°	′	″		
Nova 1572, in Caſſiopea, ...	00	13	00 –	62	58	+ N	1 — 0	Ricciolus's Almageſtum, &c.
ο Ceti	2	8	33	3	57	25 S	2 — 0	Bradley.
Algol	2	54	19	40	6	55 N	2 — 4	Mayer.
Mayer's 420th in Leo	9	36	5	12	25	00 N	6 — 0	Mayer.
In Hydra . . .	13	18	4 +	22	9	38 S	4 — 0	From my obſervat.
Nova 1604 in Serpentarius . .	17	18	00 –	21	10	½ S	1 — 0	Phil. Tr. N° 346.
β Lyræ	18	42	11	33	7	46 N	3 — 4 . 5	Bradley.
Near the Swan's head	19	38	58	26	48	½ N	3 — 0	Phil. Tr. N° 65.
η Antinoi . . .	19	41	34	00	28	14 N	3 . 4 — 5	La Caille.
In the Swan's neck	19	42	21 –	32	22	58 N	5 — 0	From my obſervat.
In the Swan's breaſt	20	9	54	37	22	37 N	3 — 0	From my obſervat.
δ Cephei . . .	22	21	00	57	20	00 N	4 . 3 — 4 . 5	Flamsteed.

Claſs the ſecond.

Names.	R. A. in time.			Declination.			Greateſt and leaſt magnitudes.	From whence reduced.
Hevelius's 6 Caſſiopeæ	00	23	16	60	50	00 N	7 — 0	Hevelius.
46 or ξ Andromedæ	1	9	46	44	24	00 N	4 . 5 — 5 . 6	Flamsteed.
50 or υ Andromedæ	1	24	16	40	20	15 N	4 . 5 — 0	Flamsteed.
Hevelius's 41 Androm.	1	28	40	41	31	¼ N	5 — .	Hevelius.
Tycho's 20th Ceti	1	39	.	13	20	. S	5 — 0	Tycho.
55 or Neb. Andromedæ	1	40	30	39	40	3 N	6 — .	Flamsteed.
Ptol. and Ul. Beigh σ Eridani . .	2	42	.	9	40	. S	4 — 0	Ul. Beigh.
41 Tauri . . .	3	53	27	27	00	39 N	5 — 0	Flamsteed.
47 Eridani . . .	4	23	54	8	41	40 S	4 — 0	Flamsteed.
Near 53d Eridani .	4	29	00	12	30	± S	4 — 0	By eſtimation.
γ Canis Majoris.	6	54	5	15	19	36 S	3 — 0	La Caille.
β Geminorum . .	7	32	11 +	28	31	38 N	1 — 3	Maskelyne.
ξ Leonis	9	20	24	12	14	23 N	4 — 6	Mayer.
ψ Leonis	9	32	3	14	59	36 N	5 . 6 — 0	Mayer.
25th Leonis . .	9	46	8	12	20	36 N	6 . 7 — 0	Flamsteed.
Bayer's *i* Leonis .	9	52	½	15	30	. N	6 — 0	Tycho.
δ Urſæ Majoris . .	12	4	45	58	13	24 N	2 — 4	La Caille.

Claſs the ſecond continued.

Names.	R. A. in Time.	Declination.	Greateſt and leaſt magnitudes.	From whence reduced.
	h. ′ ″	° ′ ″		
n Virginis . . .	12 7 43	00 24 16 N	6 0	MAYER.
BAYER's ✱ near *g* ♍	12 53 00	10 00 . S	6 – 0	From maps.
In N. thigh of Virgo	13 29 +	00 30 . S	6 – 0	From maps.
91 Virginis . . .	13 43 43	2 5 50 N	6 – 0	FLAMSTEED.
α Draconis . . .	13 58 36	65 24 8 N	2 – 4	BRADLEY.
In weſt ſcales of Libra	14 53 ½	13 26 . S	6 – 0	Mém. de l'Acad. des Sciences.
PTOL. and UL. BEIGH's 6th unformed in Libra	15 29 +	20 30 . S	4 – 7	UL. BEIGH.
κ Libræ	15 29 39	19 58 27 S	4 – .	LA CAILLE.
TYCHO's 11th Libræ	15 37 ½	19 30 . S	4 – 0	TYCHO.
33 Serpentis . .	15 38 00	17 14 00 N	6 – 0	FLAMSTEED.
Near ε Urſæ Minoris	16 ¼ .	82 ¾ . N	6 – 0	From maps.
PTOL. 14 Ophiuchi	17 2 14	26 15 37 S	4 – 0	BRADLEY.
PTOL. 13 Ophiuchi	17 18 +	20 35 . S	4 – 0	PTOL.
PTOL. 18 Ophiuchi	17 22 .	24 10 . S	5 – 0	PTOL.
σ Sagittarii . . .	18 42 00	26 32 34 S	2 – 4	MAYER.
θ Serpentis . . .	18 45 35	3 56 26 N	4 – 5	LA CAILLE.
TYCHO's 27th Capricor.	21 41 .	14 28 . S	6 – 0	TYCHO.
TYCHO's 22d Androm.	21 43 ½	49 15 . N	4 – 0	TYCHO.
TYCHO's 19 Aquarii	22 25 .	15 55 . S	6 – 0	TYCHO.
o Andromedæ . .	22 52 6	41 10 45 N	4 – 6	LA CAILLE.
LA CAILLE's 483 Zodi. Cat. . .	22 55 40	8 50 45 S	7 – 0	LA CAILLE.

I ſhall now proceed to give a ſhort account of theſe ſtars, and begin with thoſe of the firſt claſs.

The famous Nova of 1572 in Caſſiopea.

Several aſtronomers are of opinion, that it has a periodical return, which KEILL and others have conjectured to happen every 150 years. This is alſo my opinion; and I cannot think its not being noticed at the completion of every term a material objection, ſince perhaps, as with moſt of the variables, it may at different periods have different degrees of luſtre, ſo as ſometimes to increaſe only to the ninth magnitude; and if this be the caſe, its period is probably much ſhorter. This induced me, in September 1782, to take a plan of the ſmalleſt ſtars near its place, and which I have examined often ſince, but found no alteration.

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o Ceti.

Since the end of 1782 I have obſerved very exactly the decreaſe of brightneſs of this ſtar; but never have ſeen it of above the 6th magnitude. Oct. 29, 1782, it was of the 7th magnitude, and gradually decreaſed till Dec. 30, it being then of the 8 . 9th magnitude.

1783, Feb. 16, certainly leſs than the 9th magnitude.

1783, Auguſt 25, of the 6th magnitude, and gradually decreaſed until Dec. 14, being then of the 10th magnitude, and equal to the little ſtar cloſe to it.

1784, Jan. 11, I thought it by intervals ſtill leſs than the ſame little ſtar.

1784, Sept. 12, it was of the 7 . 8th magnitude, and gradually decreaſed until Dec. 9, and then was of the 9th magnitude, and rather brighter than the little ſtar.

As a matter of curioſity, I have deduced its period from the times when it was equal to a certain ſtar in the courſe of its decreaſe; the reſults were 320—337 and 328 days; but M. Cassini determined its mean period with greater exactneſs to be 334 days. Mr. Goodricke ſaw it Aug. 9, 1782, of the 2d magnitude, rather brighter than α and leſs than β Ceti. Sept. 5, it was of the 3d magnitude, being equal to γ Ceti.

Algol.

The period of Algol, diſcovered by Mr. **Goodricke**, gave us ſome new light into the nature of the fixed ſtars. Though the phænomena ſeem to attract the attention of moſt aſtronomers, ſtill there are ſome points which require further inveſtigation. Its degree of brightneſs, when at its *minimum*, is different in different periods; and alſo, I think, when at its full, it is ſometimes brighter than α Perſei, and at other times leſs. Whether theſe differences return regularly after a certain number of periods remains yet to be examined. My laſt obſervations, when it was at the middle of its *minimum*, are,

	h.	′	
1785, July 8, at	11	50	undoubtedly leſs than ϱ Perſei.
—— July 31, at	9	50	equal to ϱ Perſei.
—— Sept. 12, at	10	45	a remarkable obſervation; rather leſs than δ Perſei; evidently brighter than ϱ; nearly of the 3d mag.

Mayer's N° 420, lately diſcovered to be variable by M. Koch.

A few years before 1782, M. Koch ſaw the N° 420 undoubtedly leſs than the N° 419 of Mayer's Catalogue.

In February 1782, he found them both exactly of the ſame brightneſs, therefore of the 7th magnitude.

From an extract of a letter I have lately ſeen, the variable was of the 9th magnitude in April, 1783, and of the 10th in April, 1784.

I have often ſeen the N° 419, but never the variable, though I have frequently looked for it with a night-glaſs, and on the 4th of April, 1785, in a 3-feet achromatic tranſit inſtrument.

Variable

Variable in Hydra.

MARALDI, in 1704, having found that this ſtar had a periodical variation, continued to examine it for ſeveral years, and concluded its period to be about two years, though with conſiderable variations; in which he was much miſtaken, as will appear from the following reſults, which ſhew that its period in all probability is tolerably regular, and only of 494 days.

Dates when it was at the middle of its greateſt brightneſs, eſtimated from MARALDI's obſervations.

1704, March 14, he ſaw it nearly of the ſame magnitude from the beginning of March until the beginning of April; it then decreaſed.
1705, . . . he ſaw it very faint in November, 1705, and found it decreaſing: this obſervation is too imperfect.
1708, May 22, accurately determined; its increaſe and decreaſe being well obſerved.
1709, Nov. 10, :: doubtful, its decreaſe only being obſerved.
1712, May 1, :: ditto, ditto, ditto.
1784, Jan. 26, by me, very accurately, its increaſe and decreaſe being obſerved. See the Obſervations that conclude this paper.
1785, May 27, ditto, ditto, ditto.

The four greateſt intervals of MARALDI's Obſervations give for ſingle periods in days thus 495—517—480 and 510, the mean being $500\frac{1}{2}$, which is tolerably exact conſidering how doubtful the obſervations of 1709 and 1712 are. My two make it 487 days; but as the interval is only a ſingle period, it may err 10 days; I therefore ſhall take a mean between the reſults, which is 494, and proceed on to the following compariſons of MARALDI's two beſt obſervations with mine.

1708, May 22, 1784, Jan. 26,	interval of 56 periods, each of 493⅔ days.
1708, May 22, 1785, May 27,	interval of 57 periods, each of 493½ days.
1704, Mar. 14, 1784, Jan. 26,	interval of 59 periods, each of 494½ days.
1704, Mar. 14, 1785, May 27,	interval of 60 periods, each of 494⅕ days.
A ſingle period, on a mean,	494 days.

If MARALDI's obſervations of 1704 and 1708 are exact to a month, and there is no reaſon to believe otherwiſe, the period at that time ſeems to have been a few days longer than it is at preſent, and therefore the one here deduced may be eſteemed as the mean period.

Particulars of the changes it undergoes.

1. When at its full brightneſs it is of the 4th magnitude, and has no perceptible change for about a fortnight.
2. It is about ſix months in increaſing from the 10th magnitude, and returning to the ſame.
3. Therefore it may be conſidered as inviſible alſo during ſix months.
4. It is conſiderably quicker in increaſing than in decreaſing, perhaps by half.

Though when at its full it may always be ſtiled of the 4th magnitude, it does not conſtantly attain exactly the ſame degree of brightneſs, but the differences are very ſmall, as ſhewn below.

1704, brighter than ψ.
1708, brighter than ψ.
1784, much brighter than ψ, being nearly between ψ and γ Hydræ.
1785, rather brighter than ψ.

Its mean right aſcenſion, computed from my obſervations, and reduced to Jan. 1, 1784, is

°	′	″	
199	29	30	from 4 obſervations, compared to ζ ♍, made between March and May 1784.
199	29	21	from 2 ditto, compared to MAYER's 538, made in May, 1784.
199	29	20	from 5 ditto, compared to γ Hydræ, made between March and May, 1784.
199	29	24	— mean right aſcenſion for Jan. 1, 1784, on a mean.

HEVELIUS's 30th Hydræ is the above ſtar; he marks it of the 6th magnitude; I find it in no other Catalogue.

The famous Nova of 1604, in Serpentarius.

A full account of this ſtar is given by KEPLER, and it ſeems to have had a ſimilar appearance to the Nova in Caſſiopea; therefore the reflections delivered there need not be again repeated. In July, 1782, I took a plan of the ſmalleſt ſtars near its place, which was examined every year ſince, but no alteration was perceived.

β Lyræ.

Mr. GOODRICKE diſcovered the variation and period of this ſtar, and hopes ſoon to ſettle its different phaſes with more exactneſs; I ſhall therefore not enter into any detail, being certain it cannot be in better hands. In his laſt account he mentions having firſt ſuſpected the period to be only of ſix days nine hours; ſuch has always been my opinion, and which material point will probably be more ſatisfactorily determined in his next publication.

Nova near the Swan's Head of 1670.

This ſtar was firſt ſeen in December 1669 by Don ANTHELME; it ſoon became of the 3d magnitude, and diſappeared in 1672, after having undergone ſeveral variations. I have conſtantly looked for it ſince November, 1781, without ſucceſs; had it increaſed to only the 10th or 11th magnitude, I ſhould have perceived it, having taken an exact plan of all the ſurrounding ſtars.

η Antinoi.

The variation and period of this ſtar I diſcovered laſt year, and had the honour of communicating an account of it to the Society: as at preſent a long interval is elapſed ſince my firſt obſervations, and that lately I have noted ſome of its phaſes with exactneſs, I ſhall compare them to thoſe obſerved in 1784, which of courſe will give reſults more ſatisfactory. The period, as ſettled in my former paper, is 7 d. 4 h. 38′; but for reaſons there alledged, it muſt be much leſs preciſe than the following.

1785, July 18, at 9 h.
Sept. 6, at 18
Sept. 27, at 22

} times when η Antinoi was between its leaſt and greateſt brightneſs.

Theſe being compared to ſimilar obſervations of Sept. 12 and 19, 1784, make the length of a ſingle period thus:

D.	H.	M.
7	4	12
7	4	19
7	4	17
7	4	22
7	4	7
7	4	12
7	4	15 on a mean.

I ſee no reaſon to alter materially the other points; but believe them more exact thus:

40 hours at its greateſt brightneſs.
66 —— in decreaſing.
30 —— at its leaſt.
36 —— in increaſing.

It alſo, in every period, ſeems to attain the ſame degree of brightneſs when at its full, and to be equally decreaſed.

Variable in the Swan's Neck.

During theſe three years I have obſerved this ſtar with particular attention, as may be ſeen by the obſervations that conclude this Paper, and determined the middle time of its greateſt brightneſs very exactly, thus:

1783, July 9, of the 6 . 7th magnitude.
1784, Aug. 4, of the 5 . 6th ——
1785, Sept. 1, of the 6th ——

The ſecond of theſe, being compared to that of Nov. 20, 1687, made by KIRCH, gives 406 days exactly for one period, the interval between them being 35322 days, and divided by 87 periods. I make the diviſor 87, in order to get a reſult neareſt to that ſettled by MARALDI and CASSINI of 405, and by M. LE GENTIL of 405,3 days. We cannot ſuppoſe that theſe great aſtronomers have made any miſtake; and on the other hand, it ſeems hardly poſſible, that the mean of my obſervations alone, which makes the period 392 days, can err 14; but perhaps its period is irregular; to determine which ſeveral intervals of 15 years ought to be taken, and I am much inclined to believe, that it will be found of only 396 days 21 hours.

Particulars of the changes it undergoes.

1. When at its full brightneſs it has no perceptible change for about a fortnight.

2. It is about 3½ months in increaſing from the 11th magnitude to its full brightneſs, and the ſame in decreaſing.

3. Therefore it may be conſidered as inviſible during ſix months.

4. It does not attain the ſame degreee of brightneſs at every period, being ſometimes of the 5th, and other times of the 7th magnitude.

Its mean right aſcenſion, computed from my obſervations, and reduced to Aug. 1, 1783, is

295	33	46	from 2 obſerv. compared to γ Cygni, made in July and Auguſt, 1783.
295	33	45	from 2 ditto, compared to γ Lyræ, ditto.
295	33	45	from 1 ditto, compared to α Lyræ, made in Auguſt, 1783.
295	33	55	from 3 ditto, compared to β Lyræ, made in July and Auguſt, 1783.
295	33	52	from 2 ditto, compared to β Cygni, made in Auguſt 1783.
295	33	48½	mean right aſcenſion for Auguſt 1, 1783, on a mean.

Variable in the Swan's Breaſt.

This ſtar was firſt ſeen by G. Jansonius in 1600, and afterwards frequently obſerved by different aſtronomers, but with intervals of ten or more years, which is probably the reaſon why no regularity in its changes has yet been deduced. I have examined minutely the obſervations made in the laſt century, and ſhall venture to give the following reſults.

1. Continues at its full brightneſs for about five years.
2. Decreaſes rapidly during two years.
3. Inviſible to the naked eye for four years.
4. Increaſes ſlowly during ſeven years.
5. All theſe changes, or its period, are completed in 18 years.
6. It was at its *minimum* at the end of the year 1663.

It does not always increaſe to the ſame degree of brightneſs, being ſometimes of the 3d, and at other times only of the 6th magnitude. I am intirely ignorant whether it is ſubject to the ſame changes ſince this century, having not met with any ſeries of obſervations on it; but if the above conjectures are exact, it will be at its *minimum* in a very few years. Since November, 1781, I have conſtantly ſeen it of the 6th magnitude, being rather leſs than N° 28, 29, and *m*, and rather brighter than

36 and 40 Cygni. Sometimes I ſuſpect it has rather decreaſed within theſe two laſt years, though in a very ſmall degree.

Its mean right aſcenſion, computed from my obſervations, and reduced to Sept. 1, 1782, is

302 26 43 from 3 obſervations, compared to γ Cygni, made in October, 1781.
302 26 46 from 3 ditto, compared to γ Cygni, made in Auguſt, 1782.
302 26 52 from 1 ditto, compared to β Aquilæ, made ditto.
302 26 46 from 1 ditto, compared to α Cygni, made ditto.
302 26 39 from 1 ditto, compared to δ Andromedæ, made in October 1781.

302 26 45 mean right aſcenſion for Sept. 1, 1782, on a mean.

FLAMSTEED has this ſtar in his Catalogue; but, I believe, obſerved it only once.

δ Cephei.

This is the laſt variable ſtar diſcovered, and again by Mr. GOODRICKE. Its changes are very difficult to be ſeen, unleſs examined when at its *minimum* and full brightneſs. I have lately made ſome good obſervations on it thus:

1785, Aug. 30, at 14 h. leſs than ε Cephei.
31, at 9 h. equal if not brighter than ζ Cephei.
Sept. 15, at 12½ h. leſs than ε Cephei.
16, at 8 h. between ε and ζ Cephei.
— at 11 h. increaſed, but not as bright as ζ.
17, at 11 h. rather brighter than ζ.
26, at 11½ h. equal or leſs than ε.
27, at 8 h. evidently brighter than ζ.

Therefore it was between its leaſt and greateſt brightneſs Auguſt 31, at noon, and Sept. 26, at 21 h.: theſe being compared to *my* firſt obſervations, when alſo between its leaſt and greateſt brightneſs on Nov. 20, at 3 h. and Nov. 30, at 15 h. 1784, 1784, give the following reſults, the mean of which corroborates that deduced by Mr. GOODRICKE of 5 d. 8 h. 37′½.

	D.	H.	M.
	5	8	35
	5	8	41
	5	8	33
	5	8	39
Length of a ſingle period	5	8	37 on a mean.

δ Cephei concludes the ſtars of the firſt claſs; thoſe that follow are of the ſecond.

HEVELIUS's 6th Caſſiopeæ.

In 1782 I firſt perceived that this ſtar was miſſing; nor could I find it in 1783 and 1784.

46th or ξ Andromedæ.

This ſtar is ſaid to have diminiſhed in brightneſs. In 1784 and 1785 I found it, by very exact obſervations, leſs than υ, equal to ω*, and brighter than *d* and χ; yet I muſt mention that it is marked in my journal as being ſometimes brighter, and at other times leſs than ω*; but ſtill I am not convinced, that it varies in brightneſs. FLAMSTEED, in his Catalogue, annexes no character to his 46th Andromedæ; but in vol. II. of his Hiſt. Cœleſt. p. 135. and 138. he marks it ξ.

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* I ſuſpect an error in this character, but cannot be certain. H. E.

Flamsteed's 50, 52, τ Andromedæ, and Hevelius's 41 Andromedæ.

As the poſition and characters of theſe ſtars differ conſiderably in different Catalogues, and that ſome of them are mentioned by Cassini to have diſappeared and re-appeared, I ſhall give their brightneſs as obſerved in 1783, 1784, and 1785.

Flamsteed's 50th of the 4 . 5th magnitude, and equal, if not rather leſs than φ Andromedæ.
—— τ of the 5th magnitude, and equal to 46 and 48 Andromedæ.
—— 49 }
—— 52 } of the 5 . 6th magnitude, and are of the ſame brightneſs.
Hevelius's 41 }

A ſtar between Flamsteed's 52 and Hevelius's 41 is of the 6th magnitude, or rather leſs. I could not ſee Tycho's 19th Andromedæ; but I take this ſtar to be the ſame as Hevelius's 41 Andromedæ.

Tycho's 20th Ceti.

This muſt be the ſtar which Hevelius ſaid had diſappeared, being Tycho's ſecond in the Whale's belly. There can hardly be any doubt but that it is the χ, miſplaced by Tycho. This χ is of the 4 . 5th magnitude, and of the ſame brightneſs as the three ψ Aquarii.

Flamsteed's 55th Andromedæ, marked Neb. in his Catalogue.

It is mentioned in the lateſt Catalogues of Nebulæ that this nebula could not be found. Flamsteed, who, I believe,

only

only obſerved it once, *viz.* Oct. 17, 1691, does not mark it nebulous; nor does it appear to me ſuch, but as a ſtar of the 6th magnitude. There are a few ſmall ſtars near it, which to the naked eye, when the air is very clear, make it appear nebulous, which probably is the reaſon why FLAMSTEED marked it thus in his Catalogue.

σ or PTOL. and UL. BEIGH's 17th Eridani.

FLAMSTEED ſays, he could not ſee this ſtar in 1691 and 1692. In 1782, 1783, and 1784, I obſerved one of the 7th magnitude in that place; the relative brightneſs of which appeared always the ſame, *viz.* leſs than two little ſtars near and below η Eridani.

FLAMSTEED's 41 Tauri.

This ſtar was thought by CASSINI to be a new one or variable. I ſee little or no reaſon to be of that opinion; that it is not new is evident, ſince it is UL. BEIGH's 26th and TYCHO's 43d. In 1784 and 1785 I found it of the 5th magnitude, being equal to φ, and brighter than ψ, P, and χ Tauri.

Star about 2°¼ North of 53d Eridani, and 47 Eridani.

The firſt of theſe ſtars CASSINI thought a new one, and that it was not viſible in 1664. In 1784 I found it was leſs than ω, and *d*, brighter than A, and ſeemed equal to ψ Eridani.

CASSINI mentions another ſtar thereabouts, which he alſo eſteemed a new one: this is probably FLAMSTEED's 47th. In 1784 it appeared rather leſs than 46th.

γ Canis Majoris.

MARALDI could not ſee this ſtar in 1670; but in 1692 and 1693 it appeared of the fourth magnitude. I have very frequently noticed it ſince 1782, but perceived not the leaſt variation, being conſtantly of the 4th magnitude, very little brighter than θ, and decidedly brighter than ι.

α β Geminorum.

If either of theſe ſtars have changed in brightneſs, it is probably the β. In 1783, 1784, 1785, the β was undoubtedly brighter than α.

ξ Leonis.

MONTANARI ſays, this ſtar was hardly viſible in 1693. I found it conſtantly in 1783, 1784, and 1785, of the ſame brightneſs, being of the 5th magnitude; leſs than A, π, and, if any difference, rather brighter than h and ω Leonis. TYCHO, FLAMSTEED, MAYER, BRADLEY, &c. mark it of the 4th magnitude.

ψ Leonis.

This ſtar is ſaid to have diſappeared before the year 1667. It is now, and has ever been ſince 1783, of the 5 . 6th magnitude, being leſs than ω, and brighter than i, FLAMSTEED's 46th.

25th Leonis.

In 1783 I firſt perceived this ſtar was miſſing; nor was it viſible in 1784 and 1785, even with the tranſit-inſtrument.

BAYER's *i* Leonis, or TYCHO's 16 Leonis.

It was not viſible in 1709, nor could I ſee it in 1785. This is a different ſtar from the *i* Leonis of the other Catalogues, though TYCHO's *deſcription* of its place is the ſame.

δ Urſæ Majoris.

This ſtar is ſuſpected to change in brightneſs (ſee LONG's Aſtronomy), on account of its being marked by TYCHO, Prince of HESSE, &c. of the 2d magnitude; while HEVELIUS, BRADLEY, and others, have it of the 3d. At preſent, and for theſe three years paſt, it appears as a bright 4th magnitude, being rather leſs than ι, equal to α, and rather brighter than κ Draconis.

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n Virginis.

This ſtar is ſuppoſed to be variable, becauſe FLAMSTEED, on the 27th of January, 1680, ſays he could not ſee it. He obſerved it May 12, 1677, and ſome years afterwards, ſince it is in his Catalogue. I examined it frequently in 1784 and 1785, without perceiving the leaſt change, being of the 6th magnitude, leſs than *c*, and *rather* brighter than a ſtar three degrees lower in a right line with *c* and *n* Virginis.

BAYER's ſtar of 6th magnitude, 1° South of *g* Virginis.

This ſtar is not in any of the nine Catalogues that I have. MARALDI looked for it in vain; and in May, 1785, I could not ſee the leaſt appearance of it. It certainly was not of the 8th magnitude.

In the northern thigh of Virgo.

This ſtar, which is marked by RICCIOLUS of the 6th magnitude, could not be ſeen by MARALDI in 1709; nor was it of the 9th magnitude, if at all viſible, in 1785.

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91 or 92 Virginis.

In 1785 I found that one of theſe ſtars was miſſing, and which ſeems to be the 91; the remaining one is of the 6.7th magnitude.

α Draconis.

I am of Mr. HERSCHEL's opinion, that it is highly probable this ſtar is variable. BRADLEY, FLAMSTEED, &c. mark it of the 2d magnitude; at preſent it is only of a bright 4th. I have frequently examined it ſince October, 1782, without perceiving the leaſt change, being conſtantly rather leſs than ι Draconis, equal to δ Urſæ Majoris, and rather brighter than κ Draconis.

BAYER's ſtar in the weſt ſcales of Libra.

MARALDI ſays he could not ſee this ſtar; nor could I in 1784 and 1785. With a night-glaſs may be ſeen thereabouts ſome ſmall ſtars of about the 8th magnitude, none of which are near as bright as the 2d ν Libræ.

PTOL. and UL. BEIGH's N° 6 of the unformed in Libra.

In examining different Catalogues I do not find this ſtar in any other than the above, though it is marked of the 4th magnitude. If PTOLEMY had not the κ it might be thought to be that. In 1785 I frequently obſerved a ſtar of the 7th magnitude very near its place, which appeared rather leſs than FLAMSTEED's 41. FLAMSTEED has not this little ſtar in his Catalogue; but he obſerved it May 9, 1681.

κ Libræ.

This ſtar is thought to be variable. I am not of that opinion; though certainly it is rather ſingular that HEVELIUS, whoſe attention was directed to this part of the heavens, to find TYCHO's 11th, did not obſerve the κ; and the more ſo, as he has noticed two much leſſer ſtars not far from it. During theſe three years I have found the κ conſtantly of the 5th magnitude, being leſs than ψ or θ, equal to λ, and brighter than η.

TYCHO's 11th Libræ.

HEVELIUS ſays he could not find a ſtar of the 4th magnitude in Libra noticed by TYCHO. This muſt be TYCHO's 11th, ſince he has all the others. It was not viſible in 1783, 1784, and 1785, nor probably ever exiſted; for it is, I think, evident, that this 11th is no other than the κ, with an error of two degrees in longitude.

33 Serpentis.

In 1784 I perceived that this ſtar was miſſing; nor was it viſible in 1785 with a night-glaſs.

A ſtar marked by BAYER near ε Urſæ Minoris.

CASSINI could not ſee this ſtar. In 1782 I took, with a night-glaſs, a plan of all the ſtars near its place, and near the ε, none of which were brighter than the 7 . 8th magnitude. I have ſince re-examined the plan, but found no alteration.

The ρ or PTOL. and UL. BEIGH's 14th Ophiuchi or FLAMSTEED's 36th.

I have no doubt but that this is the ſtar which is ſaid to have diſappeared before 1695. It is alſo evident, by what HEVELIUS ſays in his Catalogue on the θ and B, that the ρ was not ſeen by him. In 1784 and 1785 I found it of the 4 . 5th magnitude, much brighter than 39, alſo rather brighter than 51 and 58, and leſs than 44. On the 30th of June, 1783, I have marked it in my journal equal to 39, and leſs than 51 and 58; but as the obſervation was not repeated, I am far from being certain it has undergone any change, particularly as this ſtar has a ſouthern declination of 26°, and therefore great attention muſt be given to the ſtate of the atmoſphere.

PTOL. 13th and 18th Ophiuchi, 4th magnitude.

If there is no error in the Catalogue, theſe two ſtars have diſappeared; but I am confident that PTOLEMY's 13th is FLAMSTEED's 40th, and that PTOLEMY's 18th ought to be marked with a north latitude inſtead of ſouth, which would make it agree nearly with FLAMSTEED's 58th.

σ Sagittarii.

Mr. HERSCHEL, with great reaſon, has placed this ſtar among thoſe which probably have changed their magnitudes. I had long ſince remarked the ſingular diſagreement in all the Catalogues, which induced me to obſerve it frequently, particularly in 1783, 1784, and 1785, when it appeared of the 2 . 3d magnitude, and brighter than π Sagittarii.

θ Serpentis.

MONTANARI ſays he ſaw this ſtar of the 5th magnitude, and that the next year it grew bigger. I examined it frequently in 1783, 1784, and 1785, and found it always leſs than δ Aquilæ, equal to β Aquilæ, and P Ophiuchi; 4th magnitude.

TYCHO's 27th Capricorni.

This ſtar was not viſible in HEVELIUS's time; nor could I ſee it 1778, 1782, 1784, with the tranſit-inſtrument.

TYCHO's 22d Andromedæ and *o* Andromedæ.

CASSINI remarked, that the ſtar placed by TYCHO at the end of the chain of Andromeda as of the 4th magnitude, was grown ſo ſmall that it could ſcarcely be ſeen. This is TYCHO's N° 22, *the longitude and latitude* of which places it near the two *π* Cygni, and where no ſtar was viſible in 1784 and 1785.

As poſſibly, by TYCHO's deſcription, CASSINI took the 22d for the *o* Andromedæ, I have alſo examined this ſtar, and in 1783, 1784, and 1785, found its relative brightneſs thus: leſs than *α* Cephei; equal to *ζ* Caſſiopeæ, though, if any difference, rather brighter; and brighter than λ, *κ*, or *ι* Andromedæ.

TYCHO's 19th Aquarii.

This is the ſtar that HEVELIUS ſays was miſſing, and that FLAMSTEED could not ſee with his naked eye Nov. 18, 1679; nor could I ſee the leaſt appearance of it in 1782. I am convinced it is the ſame ſtar as FLAMSTEED's 56th, marked *f* by BAYER, from which it is only 1°½. FLAMSTEED's 53d, marked *f* in PTOLEMY's Catalogue, is a different ſtar.

LA CAILLE's 483 Aquarii.

I firſt diſcovered that this ſtar was miſſing in 1778. It was not viſible in 1783, 1784.

There are a few other ſtars ſuſpected by the ancient aſtronomers to have been new or altered a little in brightneſs, which I have omitted, not ſeeing any reaſon to think them ſo; and ſome that are certainly variable, but cannot be obſerved in

theſe

theſe latitudes. I have alſo, contrary to my firſt intention, added ſeveral which are not mentioned by them; ſuch are thoſe that I lately diſcovered to be miſſing.

Perhaps many perſons would place in the firſt claſs ſeveral ſtars which I have put in the ſecond, relying on the poſitive aſſertions we have of their having diſappeared, diminiſhed, or being new; for my part, I am confident that moſt of theſe ſuppoſed changes may be attributed to miſtakes; and in general for thoſe that are ſaid to be loſt, an attentive compariſon of different Maps and Catalogues will point out the error; and thus I have ventured to give my opinion of TYCHO's 20th Ceti, 11th Libræ, and 19th Aquarii, &c. Since FLAMSTEED's Catalogue has been more particularly inveſtigated, the number of theſe ſuppoſed loſt ſtars is conſiderably increaſed; but if the ſecond volume of his Hiſt. Cœleſt. is alſo examined, many errors will be detected; among which it will appear very unaccountable, that the 71ſt, 80th, and 81ſt of Hercules, which were diſcovered to be miſſing by Mr. HERSCHEL, are not in FLAMSTEED's obſervations under the name of Hercules, though I looked for them with particular attention, and find the 70th. The 19th Perſei, which Mr. HERSCHEL alſo could not ſee, was obſerved but once by FLAMSTEED, *viz.* Jan. 16, 1693, and in all probability is the *τ* with the time of its tranſit erroneouſly ſet down. The *τ* was obſerved on Jan. 17, 1693, and Jan. 18, 1694. Beſides theſe Mr. GOODRICKE has found ſeveral other errors ſtill more evident. I ſcarcely need add, that theſe corrections do not in the leaſt intimate any miſtake or diminiſh the merit of thoſe that firſt point them out, but fall entirely on the ancient catalogues and obſervations.

Mr. HERSCHEL, in ſelecting ſeveral ſtars which poſſibly may be reckoned new ones, very judiciouſly gives us plauſible reaſons not to lay great ſtreſs on their being ſo; and the following remark only confirms what he there ſuggeſts; for that ſtar of *the 5th magnitude following τ* Perſei, mentioned by him, and which with great reaſon might be eſteemed a new one, is in all probability the ſame as one obſerved by FLAMSTEED, Jan. 18, 1694, though not inſerted in his Catalogue.

With regard to thoſe ſtars which are ſaid to have diminiſhed or increaſed, as thoſe in Andromeda, Leo, &c. they are, in my opinion, far from being confirmed as variable. I know, from repeated experience, that even more than a ſingle obſervation, if not particulariſed and compared with neighbouring ſtars, is very little to be depended on; different ſtates of the weather, thin ſtreaks of clouds, have ſeveral times made me err a whole magnitude in the brightneſs of a ſtar.

Whether theſe apparent changes in the ſtars proceed intirely from themſelves; or whether they are effected by any foreign power that may in part occaſion ſome of their particular appearances and irregularities, we have not ſufficient *data* to determine: but whatever are the cauſes, a diviſion of the different phænomena ſeems to be the moſt probable means of forwarding any conjecture that hereafter may be formed; I ſhall therefore divide the firſt claſs into three orders.

The firſt contains thoſe that are periodical with long intervals; and ſuch I reckon *o* Ceti, that in Hydra, that in the Swan's breaſt and neck, and alſo MAYER's N° 420.

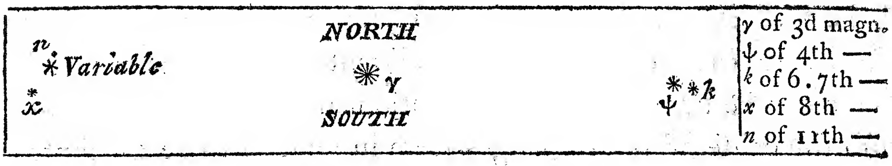
For the ſecond order I ſhall mention only three, though others might be added; but the accounts of them are ſo unſatisfactorily recorded, and their places ſo little known, that I prefer ſelecting only that in Caſſiopea of 1572, that in Serpentarius of 1604, and that near the Swan's head. The phænomena of theſe certainly bear a great reſemblance to the firſt: ſtill their ſudden appearance, and no certainty of a period, or at leaſt infinitely longer, are, I think, ſufficient reaſons to ſeparate them.

Laſtly, Algol, η Antinoi, β Lyræ, and δ Cephei, are ſo ſimilar to each other, and ſo different from the above, that there can be but little or no heſitation in diſtinguiſhing them; alſo the cauſe of their changes ſeem in general to be attributed to ſpots, and a rotation on their axis. This property of the fixed ſtars, though often ſuſpected, was far from being evident till within theſe two years; and we are not only indebted to Mr. GOODRICKE for the diſcovery of the firſt, but alſo for three of the only four known.

Further may be added, that all thoſe of the firſt order (MAYER's 420 being yet ſo little known remains doubtful) attain in different periods different degrees of brightneſs when at their full; alſo the progreſſive increaſe of brightneſs of that in Hydra, that in the Swan's breaſt, of *o* Ceti, β Lyræ, η Antinoi, and δ Cephei, is not ſimilar to their decreaſe. This peculiarity with regard to Algol is yet uncertain, owing to the rapidneſs of its changes, ſo that there is only one that ſeems to have theſe points uniform, *viz* the variable in the Swan's neck.

I ſhall now conclude with the obſervations from which ſome reſults, given in this Paper, have been deduced; they are here collected together, in order to avoid confuſion.

Obſervations on the variable in Hydra.



1783,	Dec.	11. A.M.	much leſs than ψ, and rather leſs than *k*.
		24. A.M.	equal, if not leſs than, ψ; of the ſame colour as ψ.
1784,	Jan.	4. A.M.	brighter than ψ; of about ¼ of the difference between ψ and γ; of a more copper colour than ψ.
		9. A.M.	if any difference brighter.
		10. A.M.	
		25. A.M.	with the naked eye, it appeared in brightneſs nearly between ψ and γ; and of a more copper colour than either ψ or γ.
	Feb.	1.	of the ſame brightneſs, but ſeemed of a more copper colour.
		2.	
		23.	between ψ and *k*; air not clear.
		29.	between ψ and *k*, but nearer the brightneſs of ψ.
	March	10.	
	April	11.	rather brighter than *k*.
		12.	
		19.	
	May	2.	
		9.	rather leſs than *k*, and brighter than *x*.
1784,	Dec.	1. A.M.	did not ſee the variable; ſtrong moon-light.
		9. A.M.	ditto ditto.
		22. A.M.	ditto ditto.
1785,	Mar.	4. or 11.	ditto ditto.
	April	17.	ſaw the *x*, but not the variable.
	May	4.	viſible to the naked eye; leſs than ψ, and much brighter than *k*; of a more copper colour than ψ.
		7.	rather leſs than ψ.
		11.	

1785, May 14. equal to ψ; air not very clear, and moon-light.
15. equal to ψ; air clear; moon-light.
19. undoubtedly brighter than ψ; little hazy; moon near.
22. } 27. } rather brighter than ψ; moon-light ſtrong.
June 10. rather brighter than ψ, though I think decreaſed.
12. equal to ψ: but am not ſure if the ſky was quite clear.
13. rather leſs bright than ψ; air clear.

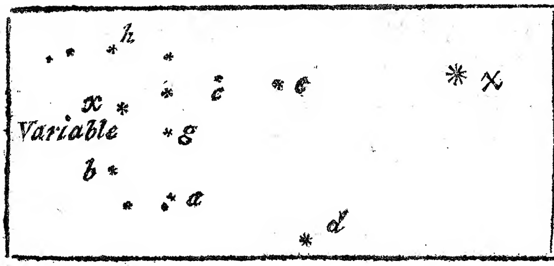
Mr. Goodricke alſo frequently obſerved the variable, and his obſervations agree with the above.

Obſervations on η Antinoi.

	h.	
1785, May 20. at	12½	equal or leſs than ι Antinoi.
21. —	12½	equal to ι, evidently leſs than β; moon-light.
22. —	12¼	equal if not brighter than β Aquilæ; moon.
— —	12⅔	thought it brighter than β; air clear.
June 10. —	12½	rather brighter than ι Antinoi.
12. —	11¾	rather brighter than ι, leſs than β.
13. —	12½	a little brighter than β, much leſs than δ.
July 15. —	12½	leſs than β, brighter than ι.
17. —	11	leſs than ι, brighter than μ.
18. —	11	between ι and β, I think rather nearer β.
19. —	10½ 11½	between β and δ, rather nearer β; air clear.
20. —	11	rather brighter than β, certainly equal.
Aug. 30. —	9½	rather brighter than β, at leaſt equal to it.
31. —	9	much brighter than β.
Sept. 6. —	9	leſs than ι; a ſingle view of it, not very ſatisfactory.
7. —	9½	much brighter than β.
26. —	9¼ 10½	much leſs than β or ι, brighter than μ.
27. —	8 10½	much leſs than β, leſs than ι, brighter than μ.
28. —	9¾	*rather* brighter than β.
— —	11	increaſed a little in brightneſs.

The brightneſs of the ſtars to which η Antinoi is compared are given in the Philoſophical Tranſactions, vol. LXXV. part I.

Obſervations on the variable in Cygnus's Neck.



χ of 6th mag.
d of 7th —
e of 7th —
a of 8th —
b of 8th —
c of 8 . 9 —
h of 9th —

As Kirch's plan (ſee Phil. Tranſ. abridged by Jones) is much the ſame as this, I have annexed the ſame letters to the ſtars.

Dates.	Mag.	
1783		
Mar. 28	0	if viſible, not of the 8th magnitude.
June 9	7	rather brighter than *d* or *e*.
11	7	rather increaſed.
23	6 . 7	leſs than χ.
30	6 . 7	rather increaſed.
July 15	6 . 7	of the ſame brightneſs as on the 30th of June.
27	7	a little brighter than *d* or *e*.
Aug. 7	7	rather brighter than *d*; decreaſed.
8	7	equal to *d*.
16	7	leſs than *d*, brighter than *e*.
25	7 . 8	leſs than *e*.
Sept. 4	7 . 8	think brighter than *a*.
12	8	equal to *a*.
22	8 . 9	much leſs than *a*, equal to *c*, and brighter than *h*.
24	9	equal to *h*.
Oct. 14	9 . 10	leſs than *h*.
24	10 . 11	ſeen with the greateſt difficulty; leſs than any ſtars of the plan; am doubtful if I ſaw it by intervals.
27		
1784	0	I looked conſtantly for the variable between October and April, but could not ſee it.
April 23	10 . 11	leſs than any ſtars of the plan.
24	10 . 11	ditto.
May 9	9 . 10	rather leſs than *h*.

Dates.		Mag.	
1784			
May	21	8 . 9	rather brighter than *h*, but not ſo bright as *b*.
June	17	8	equal to *a*, brighter than *b*.
July	21	6	equal to χ with the naked eye.
	22	6	if any difference the χ was the brighteſt.
	27	6	rather brighter than χ.
Aug.	1	5 . 6	undoubtedly brighter than χ.
	10	6	think it decreaſed, but ſtill rather brighter than χ.
	13 19	6	rather leſs than χ.
Sept.	2	6 . 7	much decreaſed, leſs than χ, but brighter than *d*.
	12	6 . 7	ſtill brighter than *d*.
	19	7	if any difference brighter than *d*.
	20	7	rather leſs than *d*.
Oct.	5	7 . 8	leſs than *e*, about equal to *a*.
	16	7 . 8	rather brighter than *a*.
Nov.	11	9	leſs than *h*, about equal to *f*.
	17	10	rather leſs than *f*.
1785			
May	9	0	not viſible.
June	21	9 . 10	leſs than *h*.
July	23	8	rather brighter than *a*.
Aug.	13 15	7	a little brighter than *d* and *e*, *much leſs* than χ; am not ſure I could ſee it with the naked eye.
	27 28	6 . 7	not ſo bright as χ, much brighter than *d*; I could ſee it with the naked eye, but the χ more diſtinctly.
	30	6	not quite ſo bright as χ; naked eye.
Sept.	2 7	6	ditto ditto.
	11 12	6 . 7	very difficult to ſee with the naked eye, decreaſed in brightneſs; air clear.
	26 27	7	though the air was remarkably clear, it was with the utmoſt difficulty I could ſometimes ſee it with the naked eye.